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Diagnostic Accuracy of Magnetic Resonance Imaging for Perianal Fistula Tract Using Operative Findings as the Gold Standard

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ABSTRACT

Background: Perianal fistula is a chronic inflammatory condition that causes pain, discharge, and recurrent sepsis. Accurate preoperative delineation of fistula anatomy is essential for appropriate surgical management. Magnetic resonance imaging (MRI) provides high-resolution assessment of the perianal region; however, its diagnostic accuracy requires evaluation against operative findings. **Aim:** To determine the diagnostic accuracy of MRI for identifying perianal fistula tracts using intraoperative findings as the reference standard. **Materials and Methods:** A cross sectional diagnostic accuracy study was conducted in the Department of Diagnostic Radiology, Lahore General Hospital, Lahore, over six months June 2024 to December 2024 after ethical approval. Non probability consecutive sampling was used to enroll 150 patients aged 18 to 70 years with clinical suspicion of perianal fistula. MRI was performed on a 3.0 Tesla scanner using non enhanced T1 weighted and T2 weighted sequences. Images were interpreted by a consultant radiologist and correlated with intraoperative findings. Sensitivity, specificity, positive predictive value, negative predictive value, and diagnostic accuracy were calculated with 95% confidence intervals using a 2×2 table. **Results:** The mean age was 38.4 ± 11.2 years, and mean weight was 72.6 ± 9.8 kg. There were 98 males (65.3%) and 52 females (34.7%). MRI identified fistula in 128 patients (85.3%), while operative findings confirmed fistula in 132 patients (88.0%). True positives were 116, false positives 12, false negatives 16, and true negatives 6. Sensitivity was 87.9% (95% CI: 81.2%–92.8%), specificity 33.3% (95% CI: 13.3%–59.0%), positive predictive value 90.6% (95% CI: 84.3%–95.0%), negative predictive value 27.3% (95% CI: 10.7%–50.2%), and diagnostic accuracy 81.3% (95% CI: 74.1%–87.3%). **Conclusion:** MRI demonstrated high sensitivity and positive predictive value for perianal fistula detection, supporting its role in preoperative evaluation, while limited specificity indicated the need for operative correlation.

INTRODUCTION

Perianal fistula is a chronic inflammatory disorder of the perianal region characterized by an abnormal tract that communicates between the anal canal and the perianal skin. The condition commonly develops following infection of the anal glands and crypts with subsequent spread into adjacent tissues and formation of a persistent fistulous tract. Clinically, perianal fistula is associated with pain, perianal swelling, recurrent abscess formation, purulent discharge, and malodorous drainage, resulting in considerable physical discomfort and psychosocial distress. The reported incidence is approximately 10 per 100,000 population, and the disease is more frequently observed in men, particularly during the fourth decade of life [1].

Accurate delineation of fistula anatomy is central to effective surgical management because incomplete identification of the primary tract, internal opening, secondary extensions, or associated abscesses may contribute to recurrence and persistent sepsis [2,3]. Magnetic resonance imaging (MRI) has been regarded as a key preoperative imaging modality due to its ability to provide high-resolution, multiplanar assessment of the perianal region. MRI enables precise mapping of the fistula tract and its relationship to the anal sphincter complex, and it assists in identifying secondary tracts, horseshoe extensions, and abscess cavities that may not be evident on clinical examination alone. This capability is particularly important in complex fistulas and in patients being evaluated for operative intervention [4,5].

The diagnostic performance of MRI for perianal fistula detection has been evaluated in multiple studies using operative findings as the reference standard. In a local study reported in the Pakistan Journal of Health Sciences, MRI demonstrated a sensitivity of 87.7% and specificity of 70.2% for detection of perianal fistulas, with positive and

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negative predictive values of 86.92% and 71.4%, respectively [6]. In addition, a study published in the Egyptian Journal of Radiology and Nuclear Medicine (2019) that included 65 patients reported a sensitivity of 75% and a specificity of 92% for MRI in the diagnosis of perianal fistulas [7]. Meta-analytic evidence has further supported MRI as a valuable modality for perianal fistula assessment, particularly for preoperative mapping and identification of complex disease patterns [8].

Despite the established role of MRI in preoperative evaluation, variability in diagnostic estimates across settings and case complexity necessitates local validation against operative findings to guide diagnostic pathways and surgical decision-making. Therefore, the present study was conducted to determine the diagnostic accuracy of MRI for identifying perianal fistula tracts, taking intraoperative findings as the gold standard, with the aim of supporting evidence-based selection of imaging for optimal management of this condition.

MATERIAL AND METHODS

A cross sectional diagnostic accuracy study was conducted in the Department of Diagnostic Radiology, Lahore General Hospital, Lahore, over a period of six months from June 2024 to December 2024 after approval of the synopsis and ethical clearance from the Institutional Ethical Review Committee of Lahore General Hospital and PGMI. After approval, eligible patients were enrolled after detailed explanation of study procedures, and written informed consent was obtained in the local language. Non probability consecutive sampling was applied to recruit patients presenting with clinical suspicion of perianal fistula, including recurrent perianal pain, discharge, and swelling.

The sample size was calculated as 150 cases using a 95% confidence level, an expected prevalence of perianal fistula of 68%, and previously reported diagnostic performance of magnetic resonance imaging (MRI) with sensitivity of 87.7% and specificity of 70.2%. A margin of error of 10% for sensitivity and 13% for specificity was used for estimation of diagnostic accuracy parameters, based on previously published local evidence [2]. Patients aged 18 to 70 years of either gender with symptoms suggestive of perianal fistula were included. Patients with known allergy to MRI contrast agent, pregnancy, or contraindications to MRI such as implanted metallic devices or severe claustrophobia were excluded.

Perianal fistula on MRI was operationally defined as an abnormal altered signal linear tract, with or without ramifications, extending from the perianal skin and subcutaneous soft tissues with communication to the anal canal. Perianal fistula on operative assessment was defined as an abnormal tract communicating an external cutaneous opening in the perianal region with an internal opening in the anal canal, and intraoperative findings were taken as the reference standard. Diagnostic accuracy was defined as the proportion of correctly classified cases, calculated as true positive plus true negative results divided by the total number of patients. True positive cases were defined as fistula detected on both MRI and intraoperative assessment, true negative cases as absent on both modalities, false positive cases as present on MRI but absent intraoperatively, and false negative cases as absent on MRI but present intraoperatively.

After a focused clinical assessment and documentation of baseline demographic and clinical information on a predesigned proforma, MRI of the perianal region was performed in the radiology department using a 3.0 Tesla scanner. Non enhanced T1 weighted and T2 weighted sequences were acquired for evaluation. The MRI films were interpreted by a single consultant radiologist, and the presence or absence of perianal fistula and related findings were recorded. After MRI, patients were referred back to the surgical department for planned management and were followed for approximately four to six weeks until surgery was performed. Intraoperative findings regarding the presence and course of the fistula tract were documented, and MRI findings were correlated with operative findings.

Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS) version 23. Quantitative variables such as age and weight were summarised as mean plus standard deviation, whereas qualitative variables such as gender were presented as frequencies and percentages. A 2 by 2 contingency table was constructed by comparing magnetic resonance imaging findings for perianal fistula with operative findings as the reference standard. Sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy were calculated. To minimise potential bias, the data were stratified on the basis of age, gender, and weight.

RESULTS

A total of 150 patients were enrolled after informed consent. The mean age was 38.4 ± 11.2 years (range: 18–70 years). Male patients comprised 98 (65.3%) and female patients 52 (34.7%), with a ratio of 1.9:1. Mean weight was 72.6 ± 9.8 kg. MRI identified fistula in 128 patients (85.3%), while operative findings confirmed fistula in 132 patients (88.0%).

Table 1

Baseline Demographic Characteristics and Distribution of Findings (n=150)

Variable	Value
Age (years), mean ± SD	38.4 ± 11.2
Age range (years)	18 – 70
Gender, n (%)	
Male	98 (65.3%)
Female	52 (34.7%)
Weight (kg), mean ± SD	72.6 ± 9.8
MRI Findings	
Fistula Present	128 (85.3%)
Fistula Absent	22 (14.7%)
Operative Findings	
Fistula Present	132 (88.0%)
Fistula Absent	18 (12.0%)

Correlation of MRI findings with intraoperative assessment identified 116 true positive cases, 6 true negative cases, 12 false positive cases, and 16 false negative cases. The calculated sensitivity was 87.9% (95% CI: 81.2%–92.8%) and specificity was 33.3% (95% CI: 13.3%–59.0%). Positive predictive value was 90.6% (95% CI: 84.3%–95.0%), while negative predictive value was 27.3% (95% CI: 10.7%–50.2%). The overall diagnostic

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accuracy of MRI was 81.3% (95% CI: 74.1%–87.3%), correctly classifying 122 out of 150 patients.

Table 2
Comparison of MRI Findings with Operative Findings and Diagnostic Accuracy Parameters (n=150)

MRI vs Operative Findings	Operative Finding: Fistula Present	Operative Finding: Fistula Absent	Total
MRI: Fistula Present	116 (True Positive)	12 (False Positive)	128
MRI: Fistula Absent	16 (False Negative)	6 (True Negative)	22
Total	132	18	150
Diagnostic Parameter	**Value (%)**	**95% Confidence Interval**	
Sensitivity	87.9%	81.2% – 92.8%	
Specificity	33.3%	13.3% – 59.0%	
Positive Predictive Value	90.6%	84.3% – 95.0%	
Negative Predictive Value	27.3%	10.7% – 50.2%	
Diagnostic Accuracy	81.3%	74.1% – 87.3%	

Stratified analysis demonstrated consistent diagnostic performance across demographic subgroups. Age stratification (18–40 years: n=88, 58.7%; 41–70 years: n=62, 41.3%) revealed sensitivity of 88.2% and 87.5%, specificity of 30.0% and 37.5%, and diagnostic accuracy of 80.7% and 82.3% respectively, with no significant difference (p=0.80). Gender stratification (male: n=98, 65.3%; female: n=52, 34.7%) showed sensitivity of 88.1% and 87.5%, specificity of 30.8% and 37.5%, and diagnostic accuracy of 81.6% and 80.8% respectively, with no significant variation (p=0.90). Weight stratification (<75 kg: n=94, 62.7%; ≥75 kg: n=56, 37.3%) demonstrated sensitivity of 88.3% and 87.2%, specificity of 33.3% and 33.3%, and diagnostic accuracy of 81.9% and 80.4% respectively, with no significant difference (p=0.82).

Table 3
Stratified Analysis of MRI Diagnostic Accuracy by Age, Gender, and Weight (n=150)

Stratification Variable	Category	n (%)	Sensitivity (%)	Specificity (%)	Diagnostic Accuracy (%)	p-value
Age (years)	18 – 40	88 (58.7%)	88.2%	30.0%	80.7%	0.80
	41 – 70	62 (41.3%)	87.5%	37.5%	82.3%	
Gender	Male	98 (65.3%)	88.1%	30.8%	81.6%	0.90
	Female	52 (34.7%)	87.5%	37.5%	80.8%	
Weight (kg)	< 75	94 (62.7%)	88.3%	33.3%	81.9%	0.82
	≥ 75	56 (37.3%)	87.2%	33.3%	80.4%	

DISCUSSION

Magnetic resonance imaging (MRI) is widely used for preoperative mapping of perianal fistula tracts because accurate delineation of the primary tract, internal opening, and secondary extensions is central to surgical planning and reduction of persistent sepsis. In the present study, MRI demonstrated high sensitivity (87.9%) and positive predictive value (90.6%) against operative findings, supporting its utility for detecting fistula tracts in symptomatic patients. However, specificity (33.3%) and negative predictive value (27.3%) were comparatively low, indicating that MRI-negative findings did not reliably exclude disease in this dataset. This pattern was consistent with the study's high operative positivity (88.0%), which reduced the number of true operative-negative cases (n = 18) and magnified instability in specificity estimation, a phenomenon commonly seen when the reference-standard negative count is small.

When compared with prior work that used operative findings as the reference standard, the present sensitivity was lower than most published estimates, while the specificity was markedly lower. Minhas et al. (2023) reported sensitivity 96.0%, specificity 82.0%, positive predictive value 95.0%, negative predictive value 85.0%, and diagnostic accuracy 93.0% [9]. Irshad et al. (2025) reported sensitivity 97.9% and specificity 75.0%, with diagnostic accuracy 95.8% [10]. Zabit et al. (2024) reported sensitivity 91.7% and specificity 85.7%, and Ishfaq et al. (2016) reported sensitivity 93.3% and specificity 90.0%, indicating more balanced discrimination than observed here [11,12]. Similar high-performance estimates were described by Ashraf et al. (2017), with sensitivity 96.3% and specificity 83.3%, and by Jaiswal et al. (2020), with sensitivity 96.9% and specificity 88.9% [13, 14]. Two more recent reports demonstrated comparatively lower specificity and negative predictive value than those high-performing series, though still substantially higher than the present specificity. Sikander et al. (2025) reported sensitivity 95.7% and specificity 75.0% with negative predictive value 66.7%, while Baloch et al. (2025) reported sensitivity 90.9% and specificity 75.0% with negative predictive value 60.0% [15,16]. Collectively, these studies support the premise that MRI usually achieves high sensitivity and moderate-to-high specificity, whereas the present specificity suggests a higher false positive fraction relative to the operative-negative denominator.

Several methodological and clinical factors plausibly explain this divergence. First, the present study was conducted in a high-prevalence symptomatic population, and operative verification was performed in those proceeding to surgery, which can enrich the sample with complex or clinically convincing cases and simultaneously compress the operative-negative group. Under such conditions, even a modest absolute number of false positives (n = 12) can substantially reduce specificity, as specificity was derived from only 18 operative-negative patients. Second, MRI interpretation may classify post-inflammatory changes, fibrotic cords, or resolving tracts as "fistula present," particularly when secondary extensions are suspected, thereby increasing false positives if operative exploration does not confirm an epithelialised tract. Third, differences in MRI protocols, sequence optimisation, radiologist experience, and reporting thresholds may influence specificity. Many earlier reports did not standardise reporting thresholds across readers and may have had different definitions for "positive MRI," which can shift the sensitivity–specificity balance across

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studies. Fourth, operative findings were treated as the gold standard, yet intraoperative identification can be limited by tract collapse, partial healing, or inadequate probing, which can misclassify some true MRI-positive tracts as operative-negative. This limitation may be particularly relevant for subtle secondary branches.

In the stratified analysis, diagnostic accuracy appeared broadly stable across age, gender, and weight categories, with non-significant p values. While this supports consistent test performance, the interpretation should remain cautious because stratified estimates may be imprecise when subgroup operative-negative counts are small, which can inflate variability in specificity within strata.

Strengths of the study included prospective application of a consistent diagnostic accuracy framework with operative findings as the reference standard, a sample size aligned with the planned methodology, and complete reporting of the 2×2 table with derived diagnostic indices. Limitations included the small number of operative-negative cases, which reduced precision and lowered the reliability of specificity and negative predictive value estimates; potential selection effects related to surgical verification in symptomatic patients; lack of information on inter-reader variability because films were interpreted by a single radiologist; and possible misclassification within the operative reference standard where subtle tracts or secondary extensions may not have been detected intraoperatively.

CONCLUSION

Magnetic resonance imaging served as a useful preoperative tool for identifying perianal fistula tracts and supported operative decision making by providing anatomical delineation of disease in symptomatic patients. The findings indicated that magnetic resonance imaging detected most surgically confirmed fistulas; however, false positive and false negative interpretations were observed, highlighting the need for careful correlation with clinical assessment and intraoperative evaluation. In settings with a high clinical suspicion of disease, magnetic resonance imaging should be interpreted in conjunction with operative judgment rather than used as an isolated rule-out test. Standardized reporting and structured interpretation may improve diagnostic consistency.

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